



National Aeronautics and Space Administration



Fall 2013

# Airborne Science Newsletter

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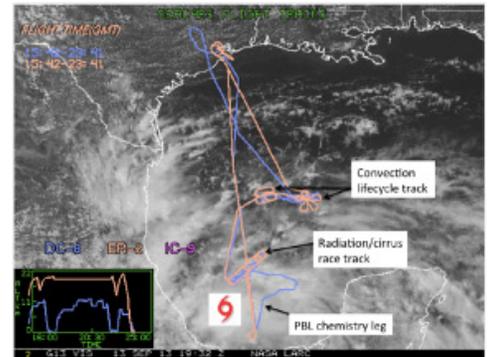
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## SEAC4RS

### Mission accomplished

The SEAC4RS mission is now complete and proved to be a great scientific success. Originally planned to take place in South East Asia, the mission moved its operations to Ellington Field, TX. With the NASA DC-8, ER-2 and the SPEC Inc. Learjet the mission flew a combined 411 flight hours during the six-week campaign. SEAC4RS flew 3 days a week, week after week, meeting all science objectives but the Gulf of Mexico hurricane mission co-incident with the HS3 Global Hawks. All SEAC4RS aircraft were operated flawlessly.

There were numerous science objectives virtually equal in scientific importance to the SEAC4RS leadership. These ranged from flying the North American Monsoon in the early portion of the mission to investigations of biogenic emissions over the South East USA. Other primary objectives in the mission included sampling the boundary layer and convective weather, as well as wild fire smoke and a hurricane in the Gulf of Mexico. Most of



Data collected on tropical storm Ingrid in the Gulf of Mexico. Image credit: Ben Scarino.

the science flights were coordinated between the ER-2 and the DC-8. The Learjet joined the DC-8 primarily for the purpose of sampling and comparing in situ microphysics data from similar instruments onboard both aircraft.

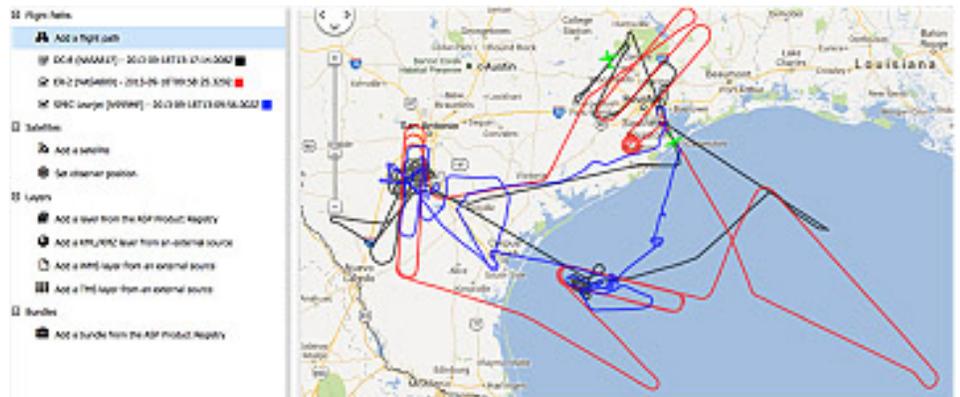
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## In Brief ...

### ER-2 Inmarsat

ER-2 real-time satellite communication capability for science instrument health monitoring, command and control and science data download has increased significantly with the recent installation of an Inmarsat antenna on tail number 809 for the SEAC4RS campaign. Inmarsat provides additional bandwidth and serves as a backup to the existing Iridium system and has already paid off in reducing pilot workload and ensuring science teams of sensor status during critical flight operations.

Contributed by Tim Moes



DC-8, ER-2, and SPEC Learjet flight tracks on 18 September 2013 (Shown on ASP flight tracker)

## SARP 2013

The fifth annual NASA Student Airborne Research Program (SARP) took place June 8-August 2 at the NASA Dryden Aircraft Operations Facility and the University of California, Irvine. The program was designed to expose advanced undergraduates majoring in the sciences, mathematics, and engineering to all aspects of a NASA Airborne Science research campaign.

The thirty-one students represented thirty-one different colleges and universities from across the United States. The program began at the Dryden Aircraft Operations Facility with introductory lectures by university faculty members, NASA scientists, and NASA program managers designed to prepare students for their flights on the DC-8. The students then participated in instrument integration and flight planning. Each student had the opportunity to fly at least three times on the DC-8. Students in the remote sensing of the ocean and land groups took ground-truth validation measurements from a research vessel in the Santa Barbara Channel and from a forest in the Sierra Nevada Mountains during a DC-8 overflight.

After the DC-8 flights, the students returned to UC Irvine for six weeks of data analysis and interpretation. The program culminated with the students' formal presentations of their results and conclusions. Eleven students submitted first-author conference abstracts on their SARP research to the American Geophysical Union Fall Meeting in San Francisco.

*Contributed by Emily Schaller*



*SARP students, mentors, and faculty pose by the DC-8 at the NASA Dryden Aircraft Operations Facility.*

## Directors' Corner



Another addition of the newsletter, and another record year for ASP. On behalf of the program and the Earth Science Division, I want to thank everyone for their individual and team efforts. Outstanding job by all! In recent weeks, the Airborne Science Program had a record day with 7 different ASP aircraft flying all the same day. Both DFRC Global Hawks flew back-to-back missions for the first time in HS3; the WFF P-3B and the LaRC UC12 flew for DISCOVER-AQ; the DFRC DC-8 and ER-2 and a commercial aircraft (Spec Lear Jet) flew for SEACR4RS; and last but not least, another DFRC ER-2 flew for HypIRI prep. In addition, the Ames' team provided critical support with mission tools, campaign logistics, outreach, and network capabilities. Johnson stepped

up to host over 300 people for both SEAC4RS and Discover-AQ. Overall, this was an incredible success and impressive performance as well as showcasing inter-Center cooperation. In addition to those missions, Wallops' C-23 just completed flying CARVE missions out of AK and their C-130 is preparing for a mission to Greenland, while Dryden's C-20 completes maintenance and prepares for a UAVSAR engineering flight series. This month, Johnson's WB-57 team is supporting a rocket launch, integrating a new science sensor, and welcoming its third WB-57 to Ellington. And for many platform and capability teams, things aren't expected to slow down once we start the new fiscal year with the P-3B deploying to McMurdo in Antarctica for OIB, Global Hawks integrating new sensors for upcoming missions, and the C-20 and G-III teams scheduled for UAVSAR and AirMOSS deployments. Besides direct support to the missions, Ames' crosscutting team will be further fielding science support capabilities, improving mission tools, accomplishing the year-end SOFRS changeover activities and much more. On behalf of the program and the Earth Science Division, I want to acknowledge all the hard work and dedication the Airborne Science Team has shown and thank everyone for their individual and team efforts. Please remember that no matter how busy we are, do it safely and when you can, take time off with your family and friends during the upcoming holidays.

*Bruce Tagg and Randy Albertson  
Airborne Science Program*



*(Left) Dr. Jack Kaye gave students an overview of NASA Earth Science research.*

*(Right) SARP Participants Tyra Brown (Millersville University of Pennsylvania meteorology major) and Sean Freeman (Florida State University meteorology major) at the University of Houston Air Quality instrument station as data is acquired during a DC-8 flight.*



# MIZOPEX

## Sea Ice mission flies in Alaska

The Marginal Ice Zone Observations and Processes Experiment (MIZOPEX) completed flights with 3 types of UAVs over the Alaskan Arctic Ocean in July-August 2013. The project goal was to assess the utility and challenges of using different classes of UAVs to characterize Arctic sea ice and ocean temperatures. The low-cost University of Colorado (CU) DataHawk was configured for water landing to collect insitu ocean temperatures, ScanEagles operated by University of Alaska – Fairbanks (UAF) obtained thermal and visible-band imagery and deployed miniaturized buoys to measure ocean subsurface temperature profiles, and the larger NASA SIERRA was fitted with multiple payloads that included radar, thermal imagers, lidar, cameras and energy-budget sensors. The mission was notable for exercising the first civilian FAA Certificate of Authorization (COA) to use ground radar as a sense-and-avoid method for transiting from restricted airspace into the National Airspace System. The COA also included a corridor from shore to international waters. In all, the project accomplished 23 flights using the 3

different UAVs. Unfortunately the SIERRA was lost during its second flight. The accident is under investigation. Preliminary results show that the combination of remote sensing and MIZOPEX buoy measurements was able to measure the evolution of subsurface and surface ocean temperatures, while thermal imaging captured complex effects of melting floes on surrounding open-ocean temperatures. Deploying 2 ScanEagles at the same time proved to be an effective means of collecting coincident data with different payloads.

The MIZOPEX PI is Jim Maslanik from the University of Colorado. The mission was managed by Randy Berthold from Ames Research Center.

*Contributed by Jim Maslanik*



*Pre-flight check of CU's DataHawk electric-powered UAV. The USAF Oliktok Point facility is seen in the background.*



*The NASA SIERRA undergoing ground checks. One of the three available payload "nose bays" is installed.*

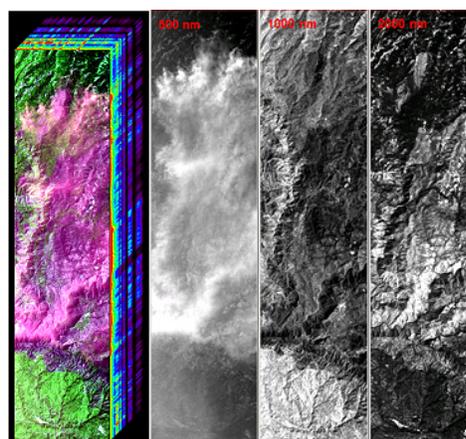
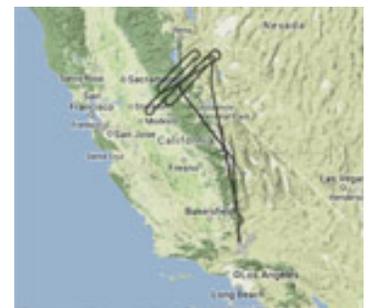


*A UAF ScanEagle with the CU air-deployed microbuoy system installed.*

# HyspIRI

## Preparatory science campaign captures Rim Fire imagery

The HyspIRI preparatory science campaign is a two-year mission to collect data and imagery for scientists to analyze in preparation for the types of data expected from the Hyperspectral Infrared Imager (HyspIRI) mission scheduled to launch in approximately 2020. The campaign involves 14 PI science groups currently flying AVIRIS and MASTER on the ER-2 over the regions in California indicated in the figure below. The objective is to advance HyspIRI mission science and algorithm readiness.



*Image credit: Robert Green*

Unexpectedly, the HyspIRI preparatory campaign had captured a large portion of the RIM fire area on September 2, before it burned. Returning on September 13th, AVIRIS obtained VSWIR spectroscopic coverage of the full RIM fire area again after it burned. The flight tracks are shown below, along with AVIRIS images from flight line #5.

VSWIR spectroscopy is used to measure fuels (species-type, water, dry biomass, etc.), hot fire temperature, smoke properties, severity and recovery processes. Fire is a key science and application area for HyspIRI. This highlights the need for HyspIRI-like routine global coverage.

# 2013 Airborne Science Program Excellence Awards

The Airborne Science Program is delighted to recognize the hard-working personnel noted below for excellence in their respective areas of endeavor. The awards were presented this summer by ASP program and center leads.

## Sustained Excellence

### Bob York

NASA DFRC  
ER-2 Engineering Support



For 24+ years providing excellent electrical design and integration of payloads on the ER-2.

## Engineering Excellence

### Mike Yandell

NASA DFRC  
Structural Engineer



For critical structural design, analysis, and review of DFRC's Airborne platforms, including a key effort preparing the DC-8 to support the SEAC4RS campaign.

## Project Management

### Cate Easmunt

NASA WFF  
Aircraft Office Support



For her efforts and "whatever it takes to get the job done" attitude allowing the GSFC WFF Aircraft Office to fly more missions and flight hours in FY12 and FY13 than ever before.

## Administrative Support

### Freddie Bynum

NASA WFF  
Aircraft Office Logistical Support



For outstanding efforts to expedite worldwide delivery of parts and equipment for aircraft and airborne science instruments, thus keeping ASP platforms on schedule and in the air.

## Leadership

### Emily Schaller

*NSERC  
Education Specialist*



For organizing and executing the Student Airborne Research Program (SARP) for 2011, 2012 and 2013, and expanding SARP into one of the top student training programs in the Earth Science Division.

## Outstanding Achievement

### Kent Dunwoody

*UC Santa Cruz  
IT Specialist*



For single-handedly building many of the hardware components for the payload IT system on the two Global Hawks, making them the successful science platforms they have become.

## Team Achievement Awards

### Airborne Science Software Tools Team, Ames

*Katja Drdla, Erin Justice, Dan Chirica, Aaron Duley, Eugene Turkov, David Van Gilst, Francis Enomoto, Sandra Johan, Patrick Finch*

For creating software tools now used operationally by ASP managers and scientists for flight planning, execution, coordination and file sharing, real-time flight tracking, science data visualization and team communications, as well as providing a centralized schedule for all science aircraft and improved reports from data collected through the on-line aircraft flight request system.

### GSFC Wallops Aircraft Office Mechanic/Technician Team

*Brian Yates, John Doyle, Todd Brophy, Wayne Jester, Kevin Moore, Pete Peyton, Jeff Sigrist, Mike Terrell, Ronnie Rose*

For keeping our ASP research platforms in the air during the busiest year in the last 20 years at GSFC WFF. From the beginning of 2012 to early 2013, the aircraft platform maintenance work requirements expanded as WFF grew from 2 to 7+ aircraft and flew over 1,400 flight hours.

**In Memoriam**

Our dear colleague Steve Wegener passed away peacefully in his sleep on Wednesday, August 14, 2013, in Fairbanks, Alaska, in the midst of an adventurous road trip, exploring the wild frontier of Alaska with two of his brothers. He had been in treatment for lung cancer for the last four years, throughout which his lust for life endured, and was expressed through abundant time with family, his ongoing environmental research, extensive travel, and his involvement in cancer treatment studies through UC Davis.



**Steve Wegener, 1946 - 2013**

Although officially retired from NASA in 2004, he never left original research, continuing his work as a scientist at the Bay Area Environmental Research Institute and with his own consultancy, Wegener Airborne Science.

Adventures were always Steve's passion; throughout his life he traveled extensively both domestically and abroad. He never turned down an opportunity for a trip, large or small, and he enjoyed the travel preparations and reflecting afterwards with friends and family as much as the adventure itself. Steve's legacy is to live everyday to it's fullest, which he did right up until the end; he will forever be admired, missed and loved.

*Contributed by Susan Schoenung*

Steve settled in Menlo Park at the US Geological Survey in 1978, where he worked for many years until his career took him to the NASA/Ames Research Center. His work at NASA Ames was pioneering, as he tackled

the new frontiers of high-altitude atmospheric research and later airborne science missions from Unmanned Aerial Vehicles (UAV).

**SEAC4RS**

*Continued from page 1*

During the third week of the mission the DC-8 flew an overnight suitcase mission to Spokane, Washington to perform extended science operations over large wild fires adjacent to Boise, Idaho and downstream where the jet stream was pushing the smoke into Canada

and the Midwest US. Later, the three aircraft continued to sample various chemistry and were able to catch Tropical Storm Ingrid in the Gulf of Mexico just before it turned into a Category 1 hurricane.



*Photo of smoke emitted by the Rim Fire burning near Yosemite, taken from the DC-8. Photo credit: Barbara Barletta.*

SEAC4RS' vast data sets will be used for years to come to assist in producing effective forecast models related to a wide variety of atmospheric interactive systems.

*Contributed by Kent Shiffer*



*End of the mission photos of the DC-8 Team (above) and the ER2 Team (right).*

# NASA SMD ESD Airborne Science Program 6-Month Schedule

SUPPORTED	Oct	Nov	Dec	Jan	Feb	Mar
DC-8	SEAC4RS		Potential ACCESS	Heavy Maintenance Check Using Boeing LUMP/Landing Gerar Swap		
ER-2 #806	HYSPIRI	HSRL HSRL Test	6 mo			HYSPIRI
ER-2 #809	SEAC4RS		6 mo			
G-III (D)	Cascade & Aleutian	California Science Flights	Maintenance	Hawaii CA So	Iceland (Notional)	Scheduled Maintenance
G-III (J)	AirMOSS AirMOSS	Decon Direct Return				Can. & SoAmer
G. Hawk #871	UAVSAR UAVSAR	NGC Upload (Tentative)				
G. Hawk #872	TWILITE Ph2	Hawkeye	ATTREX-Guam Integration & Test	ATTREX	872A ATTREX Deployment - Guam	
P-3	DISCOVER OIB Antarc	Operation Ice Bridge Antarctica-Deploy.	OIB Dnld	Maintenance	OIB Upld	OIB P3 Operation Ice Bridge
OTHER	Oct	Nov	Dec	Jan	Feb	Mar
UC-12	DISCOVER SLAP					
B200 (D)	Aircraft Insp/NAVIS review	BOS (Notional)	AirSWOT Engg Flights (Local)			
B200 (L)	DISCOVER					
B200						
C-130 Hercules						
C-23 Sherpa	CARVE Ph7	CARVE Transit	CARVE Dnld	Maintenance		CARVE Upload
Cessna						CARVE Mzn
Falcon/HU-25C	NAVAIR Air-to-Air Radar	AFRL	ACCESS 2	ACES	AFRL	AFRL
Ikhana						
Lear 25	NAIMS		Solar Cell			
S-3B	UAS in the NAS	Maintenance		UAS in the NAS		UAS in NAS
SIERRA						
T-34C				UAS in the NAS		UAS in NAS
T. Otter						
UH-1			Range Survey			
WB-57 #926						
WB-57 #928	Deployment					
COMMERCIAL AIRCRAFT						
Proteus						
Twin Otter						

- = Foreign Deployment
- = Stateside Deployment
- = Aircraft Modifications
- = Maintenance
- = Flight
- = Deployment Milestone

For an up-to-date schedule, see [http://airbornescience.nasa.gov/aircraft\\_detailed\\_cal](http://airbornescience.nasa.gov/aircraft_detailed_cal)

## ASP Upcoming Events

- \* 2013 NASA HyspIRI Science Workshop, October 15-17, 2013  
Caltech, Pasadena, CA  
Currently accepting abstracts  
<http://hyspiri.jpl.nasa.gov/events>
- \* Alaska Unmanned Aircraft Systems (UAS) Interest Group Annual Meeting  
October 22-23, 2013  
Anchorage, Alaska  
[Leonard.ligon@ataero.com](mailto:Leonard.ligon@ataero.com)
- \* SMAP Cal/Val Workshop #4  
November 5-7, 2013  
Pasadena, CA
- <http://smap.jpl.nasa.gov/science/meetings2/index.cfm?FuseAction=showMeetings2&Meetings2ID=159>
- \* Unmanned Systems Canada 2013 Annual Conference  
Vancouver Canada  
November 12-14, 2013  
<http://www.unmannedsystems.ca/>
- \* TAAC UAS 2013 Conference  
<http://taac.psl.nmsu.edu/>  
9-12 December 2013  
Santa Ana Pueblo, NM
- \* AGU Fall meeting  
December 9-13, 2013  
San Francisco, California  
<http://fallmeeting.agu.org/2013/>
- \* 2014 AGU Ocean Sciences meeting  
February 23-28, 2014  
Honolulu, Hawaii  
<http://www.sgmeet.com/osm2014/default.asp>  
STILL ACCEPTING ABSTRACTS

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# Airborne Science Program Platform Capabilities

Available aircraft and specs



Airborne Science Program Resources	Platform Name	Center	Duration (Hours)	Useful Payload (lbs.)	GTOW (lbs.)	Max Altitude (ft.)	Airspeed (knots)	Range (Nmi)	Internet and Document References
ASP Supported Aircraft	DC-8	NASA-DFRC	12	30,000	340,000	41,000	450	5,400	<a href="http://airbornescience.nasa.gov/aircraft/DC-8">http://airbornescience.nasa.gov/aircraft/DC-8</a>
	ER-2	NASA-DFRC	12	2,900	40,000	>70,000	410	>5,000	<a href="http://airbornescience.nasa.gov/aircraft/ER-2">http://airbornescience.nasa.gov/aircraft/ER-2</a>
	Gulfstream III (G-III) (C-20A)	NASA-DFRC	7	2,610	69,700	45,000	460	3,400	<a href="http://airbornescience.nasa.gov/aircraft/G-III_C-20A_-_Dryden">http://airbornescience.nasa.gov/aircraft/G-III_C-20A_-_Dryden</a>
	Gulfstream III (G-III)	NASA-JSC	7	2,610	69,700	45,000	460	3,400	<a href="http://airbornescience.nasa.gov/aircraft/G-III_-_JSC">http://airbornescience.nasa.gov/aircraft/G-III_-_JSC</a>
	Global Hawk	NASA-DFRC	30	1900	25,600	65,000	345	11,000	<a href="http://airbornescience.nasa.gov/aircraft/Global_Hawk">http://airbornescience.nasa.gov/aircraft/Global_Hawk</a>
	P-3B	NASA-WFF	14	14,700	135,000	32,000	400	3,800	<a href="http://airbornescience.nasa.gov/aircraft/P-3_Orion">http://airbornescience.nasa.gov/aircraft/P-3_Orion</a>
Other NASA Aircraft	B-200 (UC-12B)	NASA-LARC	6.2	4,100	13,500	31,000	260	1,250	<a href="http://airbornescience.nasa.gov/aircraft/B-200_UC-12B_-_LARC">http://airbornescience.nasa.gov/aircraft/B-200_UC-12B_-_LARC</a>
	B-200	NASA-DFRC	6	1,850	12,500	30,000	272	1,490	<a href="http://airbornescience.nasa.gov/aircraft/B-200_-_DFRC">http://airbornescience.nasa.gov/aircraft/B-200_-_DFRC</a>
	B-200	NASA-ARC/DOE	6.75	2,000	14,000	32,000	250	1,883	<a href="http://airbornescience.nasa.gov/aircraft/B-200_-_DOE">http://airbornescience.nasa.gov/aircraft/B-200_-_DOE</a>
	B-200	NASA-LARC	6.2	4,100	13,500	35,000	260	1,250	<a href="http://airbornescience.nasa.gov/aircraft/B-200_-_LARC">http://airbornescience.nasa.gov/aircraft/B-200_-_LARC</a>
	C-23 Sherpa	NASA-WFF	6	7,000	27,100	20,000	190	1,000	<a href="http://airbornescience.nasa.gov/aircraft/C-23_Sherpa">http://airbornescience.nasa.gov/aircraft/C-23_Sherpa</a>
	Cessna 206H	NASA-LARC	5.7	1,175	3,600	15,700	150	700	<a href="http://airbornescience.nasa.gov/aircraft/Cessna_206H">http://airbornescience.nasa.gov/aircraft/Cessna_206H</a>
	Dragon Eye	NASA-ARC	1	1	6	500+	34	3	<a href="http://airbornescience.nasa.gov/aircraft/B-200_-_LARC">http://airbornescience.nasa.gov/aircraft/B-200_-_LARC</a>
	HU-25C Falcon	NASA-LARC	5	3,000	32,000	42,000	430	1,900	<a href="http://airbornescience.nasa.gov/aircraft/HU-25C_Falcon">http://airbornescience.nasa.gov/aircraft/HU-25C_Falcon</a>
	Ikhana	NASA-DFRC	24	2,000	10,000	40,000	171	3,500	<a href="http://airbornescience.nasa.gov/aircraft/Ikhana">http://airbornescience.nasa.gov/aircraft/Ikhana</a>
	Learjet 25	NASA-GRC	3	3,200	1,500	45,000	350	1,200	<a href="http://airbornescience.nasa.gov/aircraft/Learjet_25">http://airbornescience.nasa.gov/aircraft/Learjet_25</a>
	S-3B Viking	NASA/GRC	6	12,000	52,500	40,000	450	2,300	<a href="http://airbornescience.nasa.gov/aircraft/S-3B">http://airbornescience.nasa.gov/aircraft/S-3B</a>
	SIERRA	NASA-ARC	10	100	400	12,000	60	600	<a href="http://airbornescience.nasa.gov/platforms/aircraft/sierra.html">http://airbornescience.nasa.gov/platforms/aircraft/sierra.html</a>
	T-34C	NASA-GRC	3	500	4,400	25,000	75	700	<a href="http://airbornescience.nasa.gov/aircraft/T-34C">http://airbornescience.nasa.gov/aircraft/T-34C</a>
	Twin Otter	NASA-GRC	3	3,600	11,000	25,000	140	450	<a href="http://airbornescience.nasa.gov/aircraft/Twin_Otter_-_GRC">http://airbornescience.nasa.gov/aircraft/Twin_Otter_-_GRC</a>
	WB-57	NASA-JSC	6	6,000	63,000	60,000+	410	2,500	<a href="http://airbornescience.nasa.gov/aircraft/WB-57">http://airbornescience.nasa.gov/aircraft/WB-57</a>

## ASP Upcoming Events

*Continued from page 5*

- \* 214 IEEE Aerospace Conference  
Big Sky, Montana  
March 1-8, 2014  
<http://www.aeroconf.org/>  
**Still accepting abstracts** until October 25
- \* AIAA SCI-TECH 2014  
National Harbor, MD  
January 13-17, 2014  
<https://www.aiaa.org/scitech2014/>
- \* American Meteorological Society Annual Meeting 31st Conference on Hurricanes and Tropical Meteorology  
San Diego, California  
March 31–April 4, 2014  
<http://www.ametsoc.org/MEET/meetinfo.html>  
**Abstract Deadline:** Nov 22, 2013

## Call for Content

Working on something interesting, or have an idea for a story? Please let us know, we'd love to put it into print.

Contact Susan Schoenung (650/604-6031, [susan.m.schoenung@nasa.gov](mailto:susan.m.schoenung@nasa.gov)) or Matt Fladeland (650/604-3325, [matthew.m.fladeland@nasa.gov](mailto:matthew.m.fladeland@nasa.gov)).